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[Claim(s)]

[Claim 1] Consist of soft magnetism after alloy powder and an insulating binder, and in a compound magnetic material [the presentation of said soft magnetism after alloy powder] At 1wt%<= component A<=7wt%, and 0.05wt%<= (oxygen O) <=0.6wt%, 0. Remainder is Iron (Fe) at 01Wt%<= (Manganese Mn) <=0.2Wt%. The compound magnetic material characterized by said component A containing at least one of silicon (Si), aluminum (aluminum), chromium (Cr), nickel (nickel), niobium (Nb), calcium (Ca), titanium (Ti), and magnesia (Mg).

[Claim 2] In the compound magnetic material which consists of soft magnetism after alloy powder and an insulating binder, [the presentation of said soft magnetism after alloy powder] At 1wt%<= component A<=7wt%, and 0.05wt%<= (oxygen O) <=0.6wt%, 0. Remainder is Iron (Fe) at 01Wt%<= (Manganese Mn) <=0.2Wt% and 0.01Wt%<= (Carbon C) <=0.2Wt%. The compound magnetic material characterized by said component A containing at least one of silicon (Si), aluminum (aluminum), chromium (Cr), nickel (nickel), niobium (Nb), calcium (Ca), titanium (Ti), and magnesia (Mg).

[Claim 3] The compound magnetic material according to claim 1 or 2 characterized by the mean particle diameter of soft magnetism after alloy powder consisting of 1 micrometers or more 100 micrometers or less.

[Claim 4] The compound magnetic material according to claim 1, 2, or 3 with which said component A is characterized by the coercive force of said soft magnetism after alloy powder being 1200 or less A/m including silicon (Si).

[Claim 5] The magnetic element characterized by pressurizing and fabricating the compound magnetic material of any one description of four from Claim 1.

[Claim 6] The magnetic element according to claim 5 which performs heat treatment and is characterized by things after pressurizing said compound magnetic material.

[Claim 7] The magnetic element according to claim 5 or 6 characterized by laying the coil underground into a compound magnetic material according to claim 1 or 2.
[Claim 8] The manufacture method of the magnetic element characterized by providing the following The process used as granular powder after mixing the thermosetting resin of an uncured state from Claim 1 to the soft magnetism after alloy powder of any one description of four The process which puts in and carries out pressing of this granular powder with a coil into a metal pattern The process which stiffens this thermosetting resin with heating

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[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the compound magnetic material especially used as soft magnetic materials for magnetic cores, a magnetic element, and its manufacture method about the highly efficient metal system compound magnetic material used for a transformer, a motor, chalk, a noise filter, etc.
[0002]
[Description of the Prior Art] The miniaturization of electrical and electric equipment progresses, the small and efficient magnetic material is demanded, and a ferrite magnetic core and a dust core with comparatively small holding power are used in recent years as a choking coil used by high frequency. The ferrite magnetic core has the fault that saturated magnetic induction density is small, among these. On the other hand, since the dust core which fabricates magnetic metal powder and is produced has remarkable large saturated magnetic induction density compared with soft magnetism ferrite, it is advantageous to a miniaturization. Here, in order to obtain high saturated magnetic induction density and high permeability, it being necessary to make the filling factor of magnetic metal powder high, therefore carrying out compression molding by high pressure is performed.
[0003] Although core loss of a dust core usually consists of hysteresis loss and eddy current loss, he is trying to control the development of an eddy current by covering electric insulation resin etc. on the magnetic-metal-powder surface on the other hand, since eddy current loss increases in proportion to the square of a frequency, and the square of the size into which an eddy current flows. Moreover, since shaping of a dust core is usually performed with two or more number ton/cm compacting pressure, while distortion increases as a magnetic substance, permeability deteriorates, and hysteresis loss increases. In order to avoid this, heat treatment after shaping which releasing distortion is performed, for example, is indicated to JP,H6-342714,A, JP,H8-37107,A, and JP,H9-125108,A is performed.
[0004] Moreover, the magnetic element which has outstanding magnetic characteristics is

proposed by laying a coil underground into a metal compound magnetic substance. For example, the thing which made resin distribute ferrite is used for JP,S54-163354,A and JP,S61-136213,A.

[0005]

[Problem(s) to be Solved by the Invention] However, in order to become a product density with a final shaping density in the compound magnetic material which consists of soft magnetism after alloy powder and an insulating binder as above-mentioned, two or more number ton/cm high pressure molding is usually needed. Therefore, in order for metal powder objects to contact directly or to tear insulation by the plastic deformation of a metal powder object, the problem of eddy current loss increasing has occurred. Moreover, it also sets for the magnetic element which laid the coil underground into the metal compound magnetic material. In the thing which made resin distribute ferrite by the mechanical stress by magnetic powder at the time of compression molding in addition to a thing with a high possibility that the insulating coat of a coil will be destroyed, since a limit is in the filling factor of ferrite, the problem that saturated magnetic induction density is low and direct-current superposition characteristics are bad has occurred.

[0006] It is difficult to obtain the magnetic characteristics which needed to use the insulating binder or coil which can be equal to the heat treatment, and could not heat-treat in fact in the magnetic element which built in the coil, but were excellent in heat treatment which, on the other hand, removes distortion produced by compression.

[0007] In view of the above problem, this invention solves the technical problem in a Prior art, and offers the compound magnetic material which maintains the insulation of a compound magnetic material or a magnetic element, and has outstanding characteristics, a magnetic element, and its manufacture method.

[0008]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem [the compound magnetic material of this invention] In the compound magnetic material which consists of soft magnetism after alloy powder and an insulating binder, [the presentation of said soft magnetism after alloy powder] At 1wt%<= component A<=7wt%, and 0.05wt%<= (oxygen O) <=0.6wt%, 0. Compound Magnetic Material Characterized by Remainder being Iron (Fe) at 01Wt%<= (Manganese Mn) <=0.2Wt%, Or it sets to the compound magnetic material which consists of soft magnetism after alloy powder and an insulating binder. The presentation of said soft magnetism after alloy powder at 1wt%<= component A<=7wt% And 0.05wt%<= (oxygen O) <=0.6wt%, 0. The remainder is characterized by being the compound magnetic material which is iron (Fe) at 01wt%<= (manganese Mn) <=0.2wt% and 0.01wt%<= (carbon C) <=0.2wt%. Here, it is characterized by Component A containing at least one of silicon (Si), aluminum (aluminum), chromium (Cr), nickel (nickel), niobium (Nb), calcium (Ca),

titanium (Ti), and magnesia (Mg). Moreover, it is desirable that the mean particle diameter of soft magnetism after alloy powder is 1 micrometers or more 100 micrometers or less.

[0009] In addition, when said component A contains silicon (Si), it is desirable that the coercive force of said soft magnetism after alloy powder is 1200 or less A/m, when reducing hysteresis loss.

[0010] Moreover, the magnetic element of this invention carries out pressing of said compound magnetic material, is characterized by things, and performs and fabricates heat treatment after pressurization preferably. In addition, a coil can also be laid underground into said compound magnetic material.

[0011] Furthermore, the manufacture method of the magnetic element of this invention is characterized by including the process used as granular powder after mixing the thermosetting resin of an uncured state, the process which puts in and carries out pressing of this powder with a coil into a metal pattern, and the process which stiffens this thermosetting resin with heating in said soft magnetism after alloy powder.

[0012]

[Embodiment of the Invention] The form of operation of this invention is explained hereafter.

[0013] The presentation the soft magnetism after alloy powder used by this invention at 1wt% <= component A<=7wt% And 0.05wt%<= (oxygen O) <=0.6wt%, 0. Remainder is Iron (Fe) at 01Wt%<= (Manganese Mn) <=0.2Wt%. At least one of silicon (Si), aluminum (aluminum), chromium (Cr), nickel (nickel), niobium (Nb), calcium (Ca), titanium (Ti), and magnesia (Mg) is included as a component A. It is not based in particular on the manufacture method, but what is necessary is just to consist of the above-mentioned presentation, although there are the water atomizing method, a gas atomizing method, the ingot grinding method, etc. as this manufacture method. moreover -- although powder form may be globular shape, shape [of flat], and polygon-like any -- abbreviation -- if spherical, a precise compound magnetic material can be obtained in compression molding. In addition, as for a powdered size, it is desirable that the mean particle diameter is 1 micrometers or more 100 micrometers or less. It is effective for reduction of an eddy current, and is 50 micrometers or less more preferably. Since a shaping density will become small if mean particle diameter is set to less than 1 micrometer, permeability falls and is not desirable.

[0014] Moreover, the more the coercive force Hc of soft magnetism after alloy powder is small, the more core loss reduces it, but it is 1200 or less A/m preferably.

[0015] Next, as a binder of this soft magnetism after alloy powder, it mixes with an insulating binder and is considered as a compound magnetic material. Although various resin etc. can be used as an insulating binder, in order to acquire high insulating, it is desirable to use organic system resin, such as an epoxy resin, a phenol resin, butyral resin, and organic silicone resin. And pressing of the compound magnetic material which mixed soft magnetism after alloy

powder and an insulating binder is carried out. By pressurizing, the filling factor of soft magnetism after alloy powder becomes high, and high saturated magnetic induction density and high permeability can be obtained. Here, as the pressure generally pressurized is high, the filling factor of soft magnetism after alloy powder becomes higher, but the compression distortion by pressurization arises in soft magnetism after alloy powder. This compression distortion affects the magnetic characteristics of soft magnetism after alloy powder, and causes that deterioration. Then, in order to release compression distortion, the compound magnetic material magnetic characteristics excelled [magnetic material] in heat-treating after pressing can be obtained.

[0016] Moreover, it is also possible to lay a coil underground into this compound magnetic material, and it can improve the insulating withstand voltage between a core and a coil especially. In this case, after putting soft magnetism after alloy powder and an insulating binder into the metal pattern into which the coil was put and heat-treating through pressing, it can take out from a metal pattern and a magnetic coil built-in type element can be obtained. In addition, what mixed a proper quantity of insulating binders to the manufactured soft magnetism after alloy powder in detail is used as granular powder, and the granular powder is put into a metal pattern etc. with a coil. At this time, resin can be stiffened simultaneously with heat treatment of distortion release by using a thermosetting resin as an insulating binder.

[0017] When manganese (Mn) and oxygen (O) were constituted from an above-mentioned presentation on the metal powder object beyond iron (Fe)90wt% which has high saturated magnetic induction density (more than 1.5T) by this invention as above-mentioned, the compound magnetic material or the magnetic element which was excellent in insulation, especially insulating withstand voltage, and was excellent in magnetic characteristics was found out. Although a Reason is not now necessarily clear, the oxide of manganese (Mn) is considered that insulating withstand voltage is improving by being spread to some extent inside from a metal powder body surface. As a component A, if silicon (Si), aluminum (aluminum), chromium (Cr), nickel (nickel), niobium (Nb), calcium (Ca), titanium (Ti), and magnesia (Mg) are within the limits of less than 7wt%, they will not degrade magnetic properties extremely. Moreover, when Component A is more than 1wt%, the specific resistance value of a metal powder object itself rises, and it seems that eddy current loss decreases. If it is 1wt% to 7wt% of within the limits as a whole even if it is two or more combination of Component A, there is same effect.

[0018] Moreover, when manganese (Mn), oxygen (O), and carbon (C) were constituted from an above-mentioned presentation on the metal powder object beyond iron (Fe)90wt% which is high saturated magnetic induction density (more than 1.5T), that insulating withstand voltage and magnetic properties improve also found out. Although a Reason is not now necessarily clear, when the oxide of manganese (Mn) is spread inside from the metal powder body

surface, while insulating withstand voltage improves, elaboration progresses for reducing [of carbon (C)] at the time of heat treatment, and it is thought that magnetic properties are improving.

[0019] In addition, though impurities or additives other than the above-mentioned presentation were contained in soft magnetism after alloy powder, if the quantity is little, there is same effect.

[0020] An example is hereafter given and explained as a form of more concrete operation of this invention.

[0021] Table 1 (Example 1) The shown soft magnetism after alloy powder was created by the gas atomizing method. All mean particle diameter was 10-20 micrometers, and coercive force Hc was 300 - 600 A/m. the obtained powder -- bisphenol A type resin -- 4 weight parts -- in addition, it mixed well and the particle size regulation was carried out through a mesh. Next, the 2 tiering 4.5 turn coil with an inside diameter of 5.5mm was prepared using the covering copper wire of the diameter of 1mm. After putting particle size regulation powder into a metal pattern with a coil, carrying out pressing by pressure about 3.5 t/cm2 and picking it out from a metal pattern, it heat-treated for about 1 hour, and was made to harden at about 125 degrees C. And the magnetism element with a size 12.5mmx12.5mmx thickness of 3.4-3.6mm with a built-in coil was obtained.

[0022] The inductance L value was measured with the frequency of 500kHz, and the electric current value 30A. Moreover, absolutely, withstand voltage measured electric resistance, having cut fine 100V, having come out to voltage 100-500V, and making it high, and electric resistance asked for the voltage between the coil which is important characteristics with the magnetic element under which the coil was laid, and a core which falls rapidly, and made it insulating withstand voltage with the voltage in front of that. Although it changes a little with uses, 1.2 microhenries or more and more than insulating withstand voltage 200V [of 1.0 microhenries or more] are preferably needed for an inductance L value. An evaluation result is shown in (Table 1).

[0023]

[Table 1]

試料No.	組成 (wt%)				L値 (μH)	絶縁耐電圧(V)	種別
	Si	Mn	O	Fe			
1	0.8	0.1	0.5	残	1.0	<100	比較例
2	1.0	0.1	0.3	残	1.2	300	実施例
3	7.0	0.1	0.15	残	1.1	≧500	実施例
4	8.0	0.1	0.1	残	0.9	≧500	比較例
5	5.0	0.008	0.05	残	1.3	<100	比較例
6	5.0	0.01	0.1	残	1.2	200	実施例
7	5.0	0.2	0.35	残	1.1	400	実施例
8	5.0	0.3	0.5	残	0.8	≧500	比較例
9	4.0	0.15	0.04	残	1.5	100	比較例
10	4.0	0.15	0.05	残	1.4	200	実施例
11	4.0	0.15	0.6	残	1.1	400	実施例
12	4.0	0.15	0.7	残	0.7	≧500	比較例

[0024] In the compound magnetic material which consists of soft magnetism after alloy powder and an insulating binder, the presentation of soft magnetism after alloy powder so that more clearly than (Table 1) [1wt%<=Si<=7wt%] And it turns out that L value which was excellent when the remainder was Fe at 0.05wt%<=O<=0.6wt% and 0.01wt%<=Mn<=0.2wt%, and insulating withstand voltage are realized.

[0025] (Example 2) As soft magnetism after alloy powder, the magnetic metal powder shown in (Table 2) was created by the water atomizing method. All mean particle diameter was 10-20 micrometers, and coercive force Hc was 600 - 1000 A/m. the obtained powder -- silicone resine -- 3.5 weight parts -- in addition, it mixed well and the particle size regulation was carried out through a mesh. Next, the 2 tiering 4.5 turn coil with an inside diameter of 5.5mm was prepared using the covering copper wire of the diameter of 1mm. After putting particle size regulation powder into a metal pattern with a coil, carrying out pressing by pressure about 5 t/cm2 and picking it out from a metal pattern, it heat-treated for about 1 hour, and was made to harden at about 150 degrees C. And the magnetism element with a size 12.5mmx12.5mmx thickness of 3.4-3.6mm with a built-in coil was obtained.

[0026] The inductance L value was measured with the frequency of 500kHz, and the electric current value 30A. Moreover, absolutely, withstand voltage measured electric resistance, having cut fine 100V, having come out to voltage 100-500V, and making it high, and electric resistance asked for the voltage between the coil which is important characteristics with the magnetic element under which the coil was laid, and a core which falls rapidly, and made it insulating withstand voltage with the voltage in front of that. Although it changes a little with uses, 1.2 microhenries or more and more than insulating withstand voltage 200V [of 1.0 microhenries or more] are preferably needed for an inductance L value. An evaluation result is shown in (Table 2).

[0027]

[Table 2]

試料No.	組成 (wt%)					L値 (μH)	絶縁耐電圧 (V)	種別
	Si	Mn	C	O	Fe			
13	0.8	0.08	0.1	0.5	残	1.1	<100	比較例
14	1.0	0.08	0.1	0.35	残	1.3	200	実施例
15	7.0	0.08	0.1	0.2	残	1.2	300	実施例
16	8.0	0.08	0.1	0.1	残	0.8	≧500	比較例
17	2.0	0.008	0.15	0.3	残	1.4	<100	比較例
18	2.0	0.01	0.15	0.35	残	1.3	200	実施例
19	2.0	0.2	0.15	0.5	残	1.4	300	実施例
20	2.0	0.3	0.15	0.6	残	0.9	≧500	比較例
21	3.0	0.1	0.03	0.5	残	1.1	200	比較例
22	3.0	0.1	0.04	0.4	残	1.3	300	実施例
23	3.0	0.1	0.2	0.2	残	1.5	400	実施例
24	3.0	0.1	0.3	0.1	残	1.1	≧500	比較例
25	4.5	0.2	0.08	0.04	残	1.6	<100	比較例
26	4.5	0.2	0.08	0.05	残	1.4	200	実施例
27	4.5	0.2	0.08	0.6	残	1.2	400	実施例
28	4.5	0.2	0.08	0.7	残	0.9	≧500	比較例

[0028] In the compound magnetic material which consists of soft magnetism after alloy powder and an insulating binder, the presentation of soft magnetism after alloy powder so that clearly from the result of (Table 2) [1wt%<=Si<=7wt%] And when the remainder is Fe at 0.05wt% <=O<=0.6wt%, 0.01wt%<=Mn<=0.2wt%, and 0.01wt%<=C<=0.2wt%, it turns out that outstanding L value and insulating withstand voltage are realized.

[0029] Table 3 (Example 3) The shown soft magnetism after alloy powder was created by the water atomizing method. All mean particle diameter was 8-20 micrometers. the obtained powder -- bisphenol A type resin -- 3 weight parts -- in addition, it mixed well and the particle size regulation was carried out through a mesh. Next, the 2 tiering 3.5 turn coil with an inside diameter of 4mm was prepared using the covering copper wire of the diameter of 0.8mm. After putting particle size regulation powder into a metal pattern with a coil, carrying out pressing by pressure about 3 t/cm2 and picking it out from a metal pattern, it heat-treated for about 1 hour, and was made to harden at about 120 degrees C. And the magnetism element with a size 10mmx10mmx thickness of 3.4-3.6mm with a built-in coil was obtained. The inductance L value was measured with the frequency of 500kHz, and the electric current value 30A. Moreover, absolutely, withstand voltage measured electric resistance, having cut fine 100V, having come out to voltage 100-500V, and making it high, and electric resistance asked for the voltage between the coil which is important characteristics with the magnetic element under which the coil was laid, and a core which falls rapidly, and made it insulating withstand voltage

with the voltage in front of that. Although it changes a little with uses, 1.0 microhenries or more and more than insulating withstand voltage 200V are [inductance L value of 0.8 microhenries or more] preferably needed. An evaluation result is shown in (Table 3).

[0030]

[Table 3]

試料No.	成分A	組成（wt%）					L値（μH）	絶縁耐電圧（V）	種別
		成分A	Mn	C	O	Fe			
29	無	-	0.1	0.007	0.5	残	1.1	<100	比較例
30	Al	0.8	0.1	0.007	0.4	残	1.0	100	比較例
31	Al	1.0	0.1	0.007	0.33	残	0.9	400	実施例
32	Al	7.0	0.1	0.007	0.33	残	0.8	≧500	実施例
33	Al	8.0	0.1	0.007	0.3	残	0.7	≧500	比較例
34	Si	4.0	0.008	0.01	0.15	残	1.1	<100	比較例
35	Si	4.0	0.01	0.01	0.2	残	1.1	300	実施例
36	Si	4.0	0.2	0.01	0.25	残	1.0	400	実施例
37	Si	4.0	0.25	0.01	0.25	残	0.6	≧500	比較例
38	Si	4.0	0.05	0.008	0.45	残	0.9	≧500	実施例
39	Si	4.0	0.05	0.01	0.3	残	1.1	≧500	実施例
40	Si	4.0	0.05	0.2	0.25	残	1.2	300	実施例
41	Si	4.0	0.05	0.25	0.2	残	1.2	<100	比較例
42	Ni	6.0	0.07	0.01	0.04	残	1.2	100	比較例
43	Ni	6.0	0.07	0.01	0.05	残	1.1	300	実施例
44	Ni	6.0	0.07	0.01	0.6	残	1.0	400	実施例
45	Ni	6.0	0.07	0.01	0.7	残	0.7	≧500	比較例
46	Cr	3.5	0.12	0.007	0.5	残	0.8	≧500	実施例
47	Nb	3.5	0.12	0.007	0.3	残	1.0	≧600	実施例
48	Ca	3.5	0.12	0.007	0.4	残	0.9	≧500	実施例
49	Ti	3.5	0.12	0.007	0.5	残	0.9	≧600	実施例
50	Mg	3.5	0.12	0.007	0.4	残	0.8	≧500	実施例

[0031] In the compound magnetic material which heat-treated by consisting of soft magnetism after alloy powder and an insulating binder, the presentation of soft magnetism after alloy powder so that clearly from the result of (Table 3) [1wt%<= component A<=7wt%] And the remainder is iron (Fe) at 0.05wt%<= (oxygen O) <=0.6wt% and 0.01wt%<= (manganese Mn) <=0.2wt%. When it is silicon (Si), aluminum (aluminum), chromium (Cr), nickel (nickel), niobium (Nb), calcium (Ca), titanium (Ti), and magnesia (Mg) as a component A, it turns out that outstanding L value and insulating withstand voltage are realized. Moreover, it is preferably at 0.01wt%<= (carbon C) <=0.2wt% of the time.

[0032] (Example 4) Si=3.5wt%, O=0.3wt%, the remainder is Fe at Mn=0.1wt% and the presentation created the soft magnetism after alloy powder with which grain sizes differ as shown in (Table 4) by the water atomizing method. these powder -- silicone resine -- 1.5

weight part -- in addition, it mixed well and the particle size regulation was carried out through a mesh. about 850 degrees C after carrying out pressing of this particle size regulation by the pressure two of about 8t/cm and taking it out from a metal pattern in a metal pattern -- N -- 2 inside, it heat-treated for about 1 hour, and the toroidal core-shaped dust core was obtained. About this dust core, permeability, core loss, and direct-current superposition were measured. Permeability was measured on the frequency of 100kHz in LCR meter, and core loss was measured using the exchange B-H curve measuring instrument with the measuring frequency of 100kHz, and the measurement magnetic flux density 0.1T.

[0033] Although it changes a little with uses, and three or less core loss 2000 kW/m and initial permeability are needed 60 or more in a choking coil with the measuring frequency of 100kHz, and the measurement magnetic flux density 0.1T, it is three or less core loss 1500 kW/m more preferably.

[0034]

[Table 4]

試料No.	粒径（μm）	保磁力Hc（A／m）	透磁率	コア損失（kW／m³）	種別
51	1	1100	50	900	比較例
52	2	800	60	800	実施例
53	10	500	70	1200	実施例
54	50	400	80	1500	実施例
55	60	400	100	1700	実施例
56	100	250	120	1900	実施例
57	110	200	130	2300	比較例
58	10	400	80	1100	実施例
59	10	1200	70	1800	実施例
60	10	1300	70	2400	比較例

[0035] When mean particle diameter is 1 micrometers or more 100 micrometers or less so that clearly from the result of (Table 4), it turns out preferably at the time of 1 micrometers or more of 50 micrometers or less that low loss is realized. Moreover, when the coercive force of soft magnetism after alloy powder is 1200 or less A/m, it turns out that low loss is realized.

[0036] (Example 5) aluminum=3.0wt%, O=0.2wt%, the remainder is Fe at Mn=0.2wt% and the presentation created the soft magnetism after alloy powder with which grain sizes differ as shown in (Table 5) by the gas atomizing method. these powder -- silicone resine -- 1.5 weight part -- in addition, it mixed well and the particle size regulation was carried out through a mesh. about 820 degrees C after carrying out pressing of this particle size regulation powder by the pressure two of about 8t/cm and picking it out from a metal pattern in a metal pattern -- N -- 2 inside, it heat-treated for about 1 hour, and the toroidal core-shaped dust core was obtained. Thus, permeability, core loss, and direct-current superposition were measured about the

obtained dust core. Permeability was measured on the frequency of 200kHz in LCR meter, and core loss was measured using the exchange B-H curve measuring instrument with the measuring frequency of 200kHz, and the measurement magnetic flux density 0.1T.

[0037] Although it changes a little with uses, in a choking coil, three or less core loss 6000 kW/m and initial permeability are needed 60 or more with the measuring frequency of 200kHz, and the measurement magnetic flux density 0.1T, but it is three or less core loss 4000 kW/m more preferably.

[0038]

[Table 5]

試料No.	粒径（μm）	透磁率	コア損失（kW/m³）	種別
61	1	45	3000	比較例
62	2	60	3200	実施例
63	10	70	3500	実施例
64	50	75	4000	実施例
65	60	85	6000	実施例
66	100	105	7000	実施例
67	110	130	10000	比較例

[0039] When mean particle diameter is 1 micrometers or more 100 micrometers or less so that clearly from the result of (Table 5), it turns out preferably at the time of 1 micrometers or more of 50 micrometers or less that low loss is realized.

[0040]

[Effect of the Invention] As explained above, according to this invention, a compound magnetic material with insulation and magnetic properties can be offered. This compound magnetic material can be adapted for use in a miniaturization or high frequency region of Torrance, a choking coil, etc. enough.

[Translation done.]